

WHAT IS CLAIMED IS:

1. A measuring apparatus used for a grinding tool using a grinding surface comprising a surface of a tool base on which a large number of abrasive grains are
5 discretely formed, to measure the amount of projection of each of the abrasive grains, the apparatus comprising:

a camera unit provided opposite the grinding surface to pick up an image of the grinding surface;
10 and

a control unit connected to the camera unit, the control unit comprising:

means for moving a focal position of the camera unit in a direction perpendicular to the
15 grinding surface;

means for causing the camera unit to pick up the image of the grinding surface synchronized with movement of the focal position;

detection means for comparing a predetermined
20 basic image pattern with a plurality of image data obtained by the camera unit, to detect image data approximate to the basic image pattern; and

means for calculating the amount of projection of the abrasive grains on the basis of the
25 focal position at which the detected image data was obtained by the camera unit.

2. The measuring apparatus according to claim 1,

wherein the means for moving the focal position moves the focal position step by step in increments preset on the basis of a focal depth of the camera unit, and

the means for causing the camera unit to pick up
5 an image of the grinding surface causes the camera unit to pick up the image of the grinding surface every time the focal position is moved.

3. The measuring apparatus according to claim 1,
wherein the detection means for detecting image data
10 comprises:

a memory which stores a first basic image pattern obtained when the focal position is set at a tip of the abrasive grain and a second basic image pattern obtained when the focal position is set at the surface
15 of the tool base; and

means for comparing the image data obtained by the camera unit with the first and second basic image patterns stored in the memory to detect first image data approximate to the first basic image pattern and
20 second image data approximate to the second basic image pattern on the basis of a result of the comparison, and

wherein the means for calculating the amount of projection of the abrasive grain calculates a difference between the focal position at which the
25 detected first image data was obtained by the camera unit and the focal position at which the detected second image data was obtained by the camera unit.

4. The measuring apparatus according to claim 1,
wherein the means for causing the camera unit to pick
up an image of the grinding surface stores, in an image
memory, a plurality of image data obtained by the
5 camera unit while the focal position is being moved
within a preset movement range, and

after the plurality of image data has been stored,
the detection means sequentially reads the plurality of
stored image data from the image memory to compare each
10 image data with the basic image patterns.

5. The measuring apparatus according to claim 1,
wherein every time the focal position is moved a
specified distance, the means for causing the camera
unit to pick up the image of the grinding surface loads
15 one frame of the image data obtained at the focal
position by the camera unit, and

every time the one frame of the image data is
loaded, the detection means compares the loaded one
frame of the image data with the basic image pattern.

20 6. The measuring apparatus according to claim 1,
wherein the control unit further comprises:

means for moving the grinding tool and the camera
unit in a horizontal direction relative to the grinding
surface; and

25 means for utilizing the horizontal movement to
place the camera unit opposite each of a plurality of
positions on the grinding surface to be measured.

7. A measuring method used for a grinding tool using a grinding surface comprising a surface of a tool base on which a plurality of abrasive grains are discretely formed, to measure an amount of projection
5 of the abrasive grains, the method comprising:

a step of picking up an image of the grinding surface while moving a focal position of a camera in a direction perpendicular to the grinding surface;

a step of comparing a predetermined basic image
10 pattern with a plurality of image data obtained by the camera, to detect image data approximate to the basic image pattern; and

a step of calculating the amount of projection of the abrasive grains on the basis of the focal position
15 at which the detected image data was obtained by the camera.

8. The measuring method according to claim 7, wherein the step of picking up the image of the grinding surface comprises moving the focal position
20 step by step in increments preset on the basis of a focal depth of the camera and picking up the image of the grinding surface every time the focal position is moved.

9. The measuring method according to claim 7,
25 wherein the step of detecting image data comprises storing beforehand a first basic image pattern obtained when the focal position is set at a tip of the abrasive

grain and a second basic image pattern obtained when
the focal position is set at a surface of the base, and
comparing the image data obtained by the camera unit
with the stored first and second basic image patterns
5 to detect first image data approximate to the first
basic image pattern and second image data approximate
to the second basic image pattern on the basis of a
result of the comparison, and

the step of calculating the amount of projection
10 of the abrasive grain comprises calculating a
difference between the focal position at which the
detected first image data was obtained by the camera
and the focal position at which the detected second
image data was obtained by the camera.

15 10. The measuring method according to claim 7,
wherein the step of picking up an image of the grinding
surface stores the plurality of image data obtained by
the camera while the focal position is being moved
within a preset movement range, and

20 the step of detecting image data comprises, after
the plurality of image data have been obtained by the
camera and stored, sequentially reads the plurality of
stored image data to compare each image data with the
basic image patterns.

25 11. The measuring method according to claim 7,
wherein the step of picking up an image of the grinding
surface comprises loading one frame of the image data

obtained at the focal position by the camera every time the focal position is moved a specified distance, and

the step of detecting image data comprises, every time the one frame of the image data is loaded,

5 comparing the loaded one frame of the image data with the basic image pattern.

12. The measuring method according to claim 7, further comprising:

10 a step of moving, before picking up the image of the grinding surface, the grinding tool and the camera in a horizontal direction relative to the grinding surface and aligning an image pickup surface of the camera with a position on the grinding surface to be measured.